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Mission en Indonésie
Java Centre - Moluques
février 1996

Gilbert DAVID

L'INSTITUT FRANÇAIS DE RECHERCHE SCIENTIFIQUE
POUR LE DÉVELOPPEMENT EN COOPÉRATION

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REPROGRAPHIE

Rapport d'une Mission en Indonésie
Java Centre - Moluques
février 1996

G. David

Présentation générale

La mission s'est déroulée du 11 février au 1 mars 1996 à la demande du programme d'évaluation des ressources pélagiques en mer de Java (Java Sea pelagic fish assessment project) qu'effectue l'Orstom en Indonésie sur financements européens en étroite collaboration avec le ministère des pêches à Jakarta. Il s'agissait d'apporter un appui scientifique à Isabelle Antunès, Géographe, doctorante de Paris IV, rattaché à l'UR "Modèles et réalités du développement" du département SUD, en affectation en Indonésie depuis le début 1995. La recherche d'Isabelle porte sur une approche comparative de deux villages de pêcheurs, situés l'un au centre de la côte septentrionale de java, le second dans la partie orientale de l'archipel des Moluques.

Commencé au début 1995, le premier terrain d'I. Antunes, à Java, s'achève fin mars 1996, il s'agissait donc de tirer un premier bilan des données collectées, d'identifier les données manquantes de manière à planifier le dernier mois de terrain et de préparer la première phase de rédaction, qui durant le mois d'avril, clôturera ce séjour à Java. De mai à décembre 1996, I. Antunès sera aux Moluques, la mission d'un dizaine de jours que nous y avons effectué visait à préparer ce second terrain, tant du point de vue matériel (accord des autorités locales et logement), que du point de vue scientifique. Il s'agissait notamment d'évaluer le degré d'applicabilité à ce nouveau terrain de la méthode de travail élaborée à Java et d'élaborer une nouvelle problématique pour les aspects spécifiques aux Moluques.

Cette mission a fait l'objet d'un financement conjoint des départements TOA et SUD à hauteur de 12 KF dont 6 KF pour TOA, 3 KF provenant de la réserve du département SUD et 3 KF de mon Action budgétée.

Pour des raisons de calendrier, la mission aux Moluques a précédé celle à Java mais ce dernier terrain s'achevant, et ayant mobilisé l'essentiel des recherches d'I. Antunès, je commencerai par lui.

1. Bendar - Juana : le modèle javanais

Depuis 1983, le village de Bendar s'est engagé dans la pêche hauturière de petits pélagiques à la senne tournante. C'était alors un village pauvre, peuplés de petits pêcheurs piroguiers exploitant la crevette dans les eaux côtières, au voisinage de l'estuaire de la rivière de Juana. Bendar occupait une situation périphérique, tant géographique qu'économique, par rapport à Juana, petite ville prospère, située de l'autre côté de la rivière. En 1995, Bendar a gagné la compétition nationale des villages de pêcheurs d'Indonésie et fait désormais figure de modèle à l'échelle du pays pour le dynamisme de son secteur halieutique. Comment en une douzaine d'années, ce "renversement" de situation a-t-il été possible? Quelles en sont les traductions spatiales, économiques, culturelles et sociales ? Telles sont le principales questions qui structurent l'étude d'I. Antunès.

Celle-ci se rattache tout autant à la géographie culturelle qu'à la géographie des pêches, aussi l'approche suivie est-elle originale en halieutique[1]. Elle considère la pêche comme un système socio-culturel formé de deux composantes : l'une marine, l'autre terrestre, en étroites relations avec le système villageois qui englobe totalement cette dernière.

Depuis 12 ans, l'évolution du système pêche s'est traduite par de profondes transformations du système villageois, notamment en matière d'habitat. L'analyse diachronique du paysage urbain constitue de ce fait une bonne introduction à cette évolution[2]. C'est la voie choisie par I. Antunès qui bénéficiait en la matière des résultats détaillés du recensement de 1983. Le recensement qu'elle a elle-même effectué en 1995 lui a permis d'une part de dresser une cartographie des évolutions de l'occupation du sol et du bâti de Bendar entre ces deux dates, d'autre part d'identifier l'habitat des divers acteurs du système pêche et d'en déduire une zonation de l'espace villageois, afin de comprendre

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[1] J'entends ici halieutique dans son sens très générale de "discipline multidisciplinaire" relative à la pêche et non dans son sens restreint de discipline naturaliste relative à la pêche.

[2] L'analyse du paysage urbain comme introduction à la compréhension des rapports entre l'espace la culture et la société est une approche qu'a largement pratiquée l'école de géographie culturelle de Berkeley dirigée par C. O. Sauer. L'école d'écologie urbaine de Chicago l'a également employée.

l'importance des liens de parentés dans la reproduction de la communauté de pêcheurs.

L'analyse du paysage villageois ne représente pas uniquement "l'enveloppe visuelle" de l'intersection entre le système pêche et le système villageois, elle permet également d'en esquisser le contenu, à savoir les rapports économiques, culturels et sociaux structurant ce paysage. Une analyse détaillée de ces rapports a été réalisée à travers les femmes. L'accent a été mis sur les mareyeuses dont les plus entreprenantes sont devenues armateurs de petits palangriers, qui exploitent les espèces démersales du plateau continental. A la différence des capitaines pour qui la richesse économique doit obligatoirement se traduire par le prestige social, dont la maison est la première traduction et le foncier (tambaks à crevette ou poisson lait, ou rizières) la seconde, les mareyeuses s'inscrivent dans une logique purement capitaliste de réinvestissement des profits dans la constitution d'une flotte de pêche. A moyen terme, Bendar pourrait ainsi devenir village d'armateurs au féminin et non plus un village de capitaines, les enfants de ces derniers ne souhaitant guère embrasser la profession de leur père.

A travers l'analyse diachronique du paysage, ce sont également les rapports entre Bendar et Juana qui sont ébauchés. De barrière entre une petite ville riche et un village excentré, la rivière est devenue en douze ans un trait d'union entre deux rives prospères, l'une comme l'autre tournées vers l'activité halieutique hauturière. Bendar abrite les capitaines et les mareyeuses, Juana la criée, l'association des capitaines et le principal armateur local. Se met ainsi en place un espace totalement dédié à l'halieutique, centré sur la rivière, et qui tend à se découpler au niveau fonctionnel du reste de Juana.

La partie marine du système pêche constitue le dernier volet de l'étude d'I. Antunès. Il repose sur une campagnes de trois semaines effectuées sur un senneur de 37 m. Les stratégies, les tactiques de pêche, les pratiques magiques qui leur sont associées et les principaux éléments de la vie à bord ont ainsi pu être recueillis. Les rapports de confiance tissé à cette occasion avec les capitaines ont permis à Isabelle de mettre au point un carnet de bord extrêmement détaillé. Sont notamment relevés pour chaque opération de pêche :

- les directions des vents et des courants,
- le positionnement du radeau agrégateur et du navire,
- la quantité de poissons capturée,
- la présence d'autres senneurs sur zone,
- leurs prises approximatives (information communiquée entre capitaines par radio).

Pourra ainsi être esquissée sur un échantillon de plusieurs centaines de pêche une typologie des logiques déterminant les stratégies de pêche aux échelles de la marée et de la journée ainsi que les tactiques de capture.

2. Watlaar : pêche traditionnelle et développement halieutique en milieu corallien

Watlaar est un village littoral situé sur la côte orientale de la partie septentrionale de Kay Bessar, dans la Province des Moluques. Kay Bessar est un horst soulevé aux récifs frangeants peu développés et à la pente récifale très accore au delà de 200 à 500 m du rivage. La quasi totalité des villages de l'île étant située sur le littoral, la pêche occupe une place de choix dans l'économie locale, tant dans le domaine vivrier que dans le domaine commerciale ; les coquillages nacriers, notamment trocas (*Trochus niloticus*) et burgaus (*Turbo marmoratus*), constituent avec le coprah la principale source de revenus.

Cette partie orientale de l'archipel indonésien est actuellement soumise à deux processus majeurs :

- l'un est endogène, il s'agit du désir des populations locales de développer leur pêche côtière pour éviter l'exode vers les centres urbains, dans ce contexte le modèle javanais développé à Bendar est-il applicable aux Moluques ? répondre à cette question nécessite une étude approfondie du système halieutique en place à Kay Bessar pour estimer sa capacité à générer des innovations et à en recevoir avec profit de l'extérieur ;
- l'autre processus est exogène, il s'agit de l'arrivée dans ces eaux encore souvent vierges de toute exploitation halieutique de navires hauturiers en provenance de l'ouest du pays. Face à la surpêche grandissante en mer de Java que ne manquera pas de produire l'accroissement de la flotte hauturière javanaise, l'est du pays est-il l'espace vers lequel se redéploiera une partie de cette flotte dans les années à venir ? Dans ce contexte ne risque-t-il pas d'y avoir des conflits d'usage entre pêcheurs locaux et flotte extérieure, surtout si les premiers accroissent de manière importante leur effort de pêche en s'inspirant du modèle javanais?

Voilà le premier trait d'union entre le premier terrain d'I. Antunès à Java et le second aux Moluques. Il s'ancre dans la problématique générale du développement durable en milieu insulaire. Le second trait d'union est plus culturel et moins appliqué. A travers deux milieux géographiques différents (récifs coralliens et fonds sédimentaires de

faible profondeur) mais une même activité (la pêche), il s'agit d'étudier les relations environnement-société, notamment le déterminisme de la nature dans l'élaboration d'une culture et la relation symétrique par laquelle la culture modèle l'exploitation de la nature.

Cette dernière problématique s'est révélée essentielle dans le choix du second terrain d'I. Antunes. Bien que le milieu récifal y soit moins développé qu'à Kay Kecil, Key Bessar a été préféré à cette dernière car la culture halieutique traditionnelle y était plus forte. A Key Bessar, le choix s'est porté sur le village de Watlaar, capitale du royaume du nord, pour laquelle existent des plans et des cartes datant d'une vingtaine d'années, à la différence des autres village du royaume. L'assurance de pouvoir bénéficier de la coopération du roi s'est également révélée déterminante.

Comme à Bendar, l'étude d'Isabelle commencera par une cartographie détaillée du village de Watlar. L'objectif n'est pas ici d'approcher la dynamique du système pêche à travers l'habitat mais d'identifier la relation entre l'organisation spatiale du village d'une part et d'autre part les liens de parenté et l'organisation sociale qui en découle. Les premières enquêtes effectuées durant la mission montrent une grande symétrie entre l'organisation de l'espace terrestre non bâti et l'organisation de l'espace marin, et laissent supposer le rôle fondamental de la parenté comme facteur de structuration du foncier (tant terrestre que marin) et de son usage ; le foncier serait alors un des ensembles clef du système villageois.

Une fois celui-ci esquissé, sera abordée l'étude du système pêche, notamment l'accès à la ressource. Celui-ci est limitée dans le temps et dans l'espace par des règle coutumières, codifiées oralement sous le nom de Sasi. A Watlaar, le Sasi s'applique à l'ensemble de la zone intertidale et aux coquillages nacriers de la pente récifale. La prise en compte de ces espèces d'intérêt commercial montre que le Sasi n'est pas figé dans le temps mais sujet à des adaptations, fonction de l'intérêt communautaire.

Développer la pêche commerciale dans un soucis de pérennité de l'activité conduit à modifier le Sasi dans le sens d'une exploitation maximale de la ressource à l'équilibre. Tel n'est pas encore le cas. Ainsi l'ouverture du Sasi est-elle déterminée par un facteur physique : les marnages les plus élevées de l'année et ne prend pas en compte les paramètres biologiques des espèces exploitées, notament leur maturité sexuelle. Ainsi l'ouverture du Sasis en Novembre intervient au tout début de la période chaude, avant que les trocas n'aient eu le temps de

se reproduire. Repousser la période d'ouverture du Sasi après cette période de ponte permettrait un meilleur recrutement ultérieur. L'abalone constitue un autre exemple ; son l'exploitation commence à peine à Watlaar et ce mollusque n'est pas inclus dans le Sasi, hormis les juvéniles présents dans la zone intertidale. L'analyse des limites du Sasi et des améliorations à y apporter dans l'optique d'une exploitation optimale du milieu devrait être réalisée par Joyce DANGEUREN, Professeur de Biologie marine à l'Université Patimuhra d'Ambon, en étroite liaison avec Isabelle qui travaillera de son côté sur l'aspect anthropique de cette question.

Bilan

La quantité impressionnante d'informations recueillies par Isabelle Antunès à Bendar, tant en ce qui concerne les opérations à la mer qu'à terre, le système pêche que le système villageois, devrait lui permettre de réaliser une synthèse tout à fait originale et très documentée sur le développement de la pêche dans cette partie de Java. Le second terrain aux Moluques s'avère également très prometteur. L'ensemble devrait constituer une thèse fort intéressante, associant géographie des pêches et géographie culturelle.

Sa phase de terrain achevée, I. Antunès devra concrétiser l'investissement considérable qu'elle a concédé durant les 9 mois passés à Bendar et à Watlaar. Le mois de pré-rédaction qu'elle passera en Avril 1996 à la synthèse des notes engrangées à Bendar devrait lui faciliter la tâche. Une affectation d'un an dans un centre Orstom, où elle pourra trouver un appui scientifique solide lui permettra de mener à bien sa rédaction et de produire une thèse de qualité, la première en géographie des pêches sur cette région du monde.

Calendrier de la mission

11/2/96 Voyage aérien Sydney-Jakarta

12/2/96 Voyage aérien Jakarta-Ambon.
Premier contact avec l'archipel des Moluques, notamment les îles Kay : panorama cartographique et discussion avec les responsables de l'ONG Baleo.
Discussion avec Isabelle de la méthodologie suivie à Bendar et de son applicabilité aux Moluques.

13/2/96 Voyage aérien Ambon-Tual (Kay Kecil).
Rencontre dans le village d'Evu avec l'ONG locale supportée par Baléo et intervenant dans les deux îles Kay. Discussion sur le Sasi et l'organisation traditionnelle de la pêche.
En soirée, rencontre avec quatre missionnaires de la Banque Mondiale, chargés de promouvoir le développement durable des îles Kay. Un autre projet d'envergure de la Banque portant sur l'étude et la protection des récifs coralliens de l'Indonésie Orientale est également en cours. Il est piloté par "la Great Barrier Reef Park Authority" et devrait aboutir au classement des espaces coralliens les plus remarquables en vue de leur protection contre la surpêche et surtout l'emploi de Cyanide pour la capture des poissons d'aquarium (Une mission récente, financée par l'ONG américaine "National Conservancy", réalisée par R. Johannes et M. Riepen, dont les résultats ont été présentés à la dernière conférence des pêches de la Commission du Pacifique Sud à Nouméa a fait le point sur cette question).

14/2/96 Voyage maritime Tual-Watlaar (Kay Besar) d'une durée de 8 heures. En d'après midi à Watlaar, rencontre avec les autorités locales et discussion avec J.P. Rahail, roi de la partie septentrionale de Kay Bessar, sur l'histoire du village de Watlaar et de son royaume.

15/2/96 Journée consacrée à l'étude de la pêche traditionnelle.
Brève visite du village de Watlaar puis promenade avec le roi le long du littoral en discutant du Sasi, forme la plus commune de contrôle de l'accès à la ressource, jusqu'au promontoire duquel le Sasi est ouvert. Embarquement pour assister au mouillage et à la relève de casiers à poissons. Discussion sur l'appropriation foncière dont cette forme de pêche fait l'objet .

L'après-midi et la soirée seront consacrées à l'organisation spatiale et sociale du foncier maritime et au Sasi. En cours de discussion, il apparaît que l'organisation de l'espace terrestre est similaire à celle de l'espace marin, c'est la raison pour laquelle nous décidons de partir le lendemain visiter les jardins de l'intérieur des terres.

16/2/96 Journée consacrée à l'étude de l'organisation spatiale terrestre et aux relations avec le foncier marin. De 8h à 14 h sorties : dans les jardins, relevé des limites entre parcelles et du découpage en altitude de l'espace. En fin d'après midi et soirée, nouvelle rencontre avec le roi pour approfondir les aspects vus le matin.

17/2/96 Visite plus détaillée du village, évaluation des travaux à réaliser dans la maison qui sera attribuée à Isabelle pour son séjour de 6 mois à Watlar.
Visite également d'un chantier naval où un des fils du roi achève un navire d'une douzaine de mètres. Discussion à cette occasion sur les développement des pêches tel qu'il est souhaité par les villageois et leurs autorités.
En soirée spectacle folklorique et discours clôturant notre mission dans le village.

18/2/96 Voyage maritime Watlaar-Tuhal. En fin d'après midi synthèse avec Isabelle sur l'organisation sociale traditionnelle de Key Bessar.

19/2/96 Voyage aérien Tual-Ambon et synthèse avec Isabelle des informations recueillies à Watlar.

20/2/96 Le matin rencontre avec un professeur de Droit de l'Université Patimuhra d'Ambon étudiant les droits coutumiers aux Moluques et l'adéquation entre le droit civil actuel et le droit coutumier traditionnel.
En fin d'après midi et soirée, rencontre avec Joyce DANGEUREN, enseignante de biologie marine à l'université Patimuhra. Originaire de Kay Bessar, Malacologue, elle se spécialiste depuis quelques années dans l'écologie des mollusques commerciaux, abalone, burgaux (*Turbo marmoratus*) et trocas (*Trochus niloticus*), notamment l'écologie de leurs larves. C'est à ce titre que Joyce se rendra en Juin 1996 au Vanuatu, à la demande du Service des pêches de Port-Vila pour étudier les prédateurs des petits trocas issus d'aquaculture. A Kay Bessar, Joyce travaillera

en étroite collaboration avec Isabelle pour étudier les limites actuelles du Sasi et les modifications souhaitables à y apporter pour une meilleure protection de la ressource. Titulaire d'un Master de l'université du Nouveau Brunswick au Canada (équivalent DEA), Joyce DANGEUREN désirerait profiter de ces relations nouvelles avec l'Orstom pour s'inscrire en thèse en France et est prête à s'investir dans l'apprentissage de la langue française. Cette demande traduit l'image très positive dont jouit l'université française auprès de nos partenaires indonésiens et il serait dommage de ne pas y répondre. De prime abord, Brest et Perpignan me viennent à l'esprit comme laboratoire d'accueil possible.

21/2/96 Voyage aérien Ambon-Sémarang via Ujung Pendang, Denpassar et Surabaya, puis transfert routier Semarang-Juana.

22/2/96 Rencontre avec les autorités du village de Bendar et quelques capitaines de senneurs.
Visite du village de Bendar.

23/2/96 Organisation spatiale du village, synthèse avec Isabelle des principaux résultats de son terrain.
Visite du village de Juana.
En soirée, rencontre avec le principal armateur de senneurs de Juana-Bendar.

24/2/96 Visite du port de Juana-Bendar à quai et sur l'eau.
Synthèse des résultats obtenus par Isabelle lors de ces sorties en mer sur les stratégies et tactiques de pêche.

25/2/96 Journée entièrement consacrée à la fête de la mer.

26/2/96 Suite et fin de la synthèse concernant les stratégies et tactiques de pêche.
Discussions sur les 3 types de pêche rencontrés à Bendar.
Mise au point du plan définitif de la thèse.

27/2/96 Rencontre avec une mareyeuse et synthèse avec Isabelle sur la place des femmes dans le système pêche.
Synthèse sur les interactions entre le système pêche et le système villageois et interrogations sur la viabilité à court et moyen termes de la pêche à Bendar.

28/2/96 Voyage Juana-Semarang-Jakarta.

29/2/96 Bilan de la mission au Ministère indonésien des pêches et présentation de la pêche villageoise dans le Pacifique Insulaire à une vingtaine de chercheurs du ministère (Annexe 2).

1/3/96 Travail au projet PELFISH et en soirée départ pour Sydney.

2/3/96 Transit d'une journée à Sydney.

3/3/ 96 Voyage Sydney-Nouméa

TABLE DES MATIERES

ANNEXES

ANNEXE 1

RESEARCH FIELD PLAN

DESA WATLAAR - KEI BESAR

ANNEXE 2

VILLAGE FISHERIES IN THE PACIFIC ISLANDS

RESEARCH FIELD PLAN

DESA WATLAAR - KEI BESAR

INTRODUCTION

Geographical description of the Kei Islands (geology, climat, vegetation, ...).

Presentation of the people from Kei, their culture, social organization and the notion of political territories in these islands.

Presentation of Desa Watlaar and reason of choice of field work. Economic and geo-political context of the Kei islands.

I - THE VILLAGE SYSTEM

This study will attempt to describe this organization and how the past history is written in the landscape.

A - The village territory spatial organization.

1 - The village
1-1. The village as an entity
1-2. The various parts of the village

2 - The rural and marine spatial areas

B - Social and economic organization

1 - The population
1-1. Demography : age and gender structure
1-2. Kinship

2 - The activities

3 - Cartography

II - THE FISHING SYSTEM

This study will attempt to describe the fishing system and its importance and role within the social and economic organization.

A - The resource and its exploitation

1- The resources, fishing equipments and fishing technics
2 - Knowlegde and beliefs

B - The marine environment and the resource management : the Sasi

1 - Fishing grounds and sea marine tenure
2 - Description of the Sasi
3 - Perception of the resource

C - Utilisation of the production

1 - Self comsumption
2 - Commercialization
3 - Economic importance
4 - Community based sharing system

III - THE FISHING SYSTEM AND DEVELOPMENT

A - Exploitation of marine resource : an activity in expansion

1 . In Watlaar
1-1 . Introduction of new fishing devices and inovation
1-2 . Increasing number of species being commercialized

2 . By non-local fishermen
2-1 . Rising conflit with local fishermen
2-2 . Exploitation of the resource by means of destructive devices (dynamite and cynaide).

B - Towards a sustainable development

1 . Adaptation of Sasi
2 . The limits of Sasi

C - Culture and Identity

The development slowly builds itself on traditional practices, knowledge and beliefs and in doing so finds an identity within its culture to confront the problems that come from development.

1 . Sasi, a way to conservation and sustainable development
2 . Sasi, a way both to integrate and to react to development

CONCLUSION

How is Watlaar representative of the other villages of Kei? This study will try to compare Watlaar with few other villages in Kei Besar and in Kei Kecil where Sasi has been maintained and where it has not, and its effects on the environment and the people.

The work of Bapak Raja to master its own development through Sasi and to revive the importance of culture in Watlaar and his people in a region of the world of very high but also vulnerable biodiversity.

VILLAGE FISHERIES IN THE PACIFIC ISLANDS

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ABSTRACT

With the exception of P.N.G., village fishing plays a very important role in the dietary self-reliance of the island nations of the Pacific. On an average, 35 to 45% of the islanders go fishing at least once a week in order to feed their family. The production of subsistence fishing represents approximately 80,000 tonnes per year. By comparison, the production of commercial artisanal fishing, which enjoys the financial and technical back-up of the authorities, is low (16,400 tonnes of fish and 1,900 tonnes of crustaceans).

Many of the projects which aimed at the creation of a pool of professional commercial fishermen resulted in failure, whether the target was deep-bottom fishing on the outer slopes of the reef wall or fishing for pelagic species around fish aggregation devices. Even though this structured sector suffers from stagnation, village fishing is being drawn in a vast movement of integration in the market economy. The commercial gathering of sea-slug and pearl-shell, particularly troca, may represent locally a subtantial part of the cash income of foreshore populations. An increasing percentage of the product of subsistence fishing (10 to 50%) is now being offered for sale, and the notion of selling as motivation for going fishing is spreading.

The increase in fishing effort which results from this evolution raises the problem of rational resource management to the level of urgent concern. Much thought is being given to the introduction of fishing regulatory mechanisms making use of the village marine tenure system, through temporary bans on fishing.

Key -words : villages fisheries, food security, development, Pacific islands.

1. INTRODUCTION

The establishment of the Exclusive Economic Zones had raised high hopes among the small island nations of the Pacific that tuna fisheries would make a large contribution to their economic development. To some extent, these hopes have been disappointed. The cost of developing a national fishing fleet turned out to be too high for their financial resources. Many of these nations now consider the granting of fishing licences as the surest and least expensive way of getting a fair return on the harvesting of their offshore resources, and feel that they should target their development efforts on coastal fishing. Coastal fishing is carried out at village scale, and is of primary importance for the dietary self-reliance of the islanders. Village fishing mostly consists of a structured sector, of a semi-structured sector, and of a completely non-structured sector. The former benefits from a the existence of a commercial network capable of absorbing the greater part of the catch, and occasionally from technical back-up and financial assistance from the banks; the latter on the other hand, consists of a number of simple artisanal operations often derived from traditional fishing methods, and concerns mostly subsistence fishing activities. The semi structured sector is based mainly on the gathering of the sea-slug (beche-de-mer) and pearl-shell, which addresses an international market, but its organisation and means of production are those of traditional fishing.

Following a brief description of the economic and geographic context of the island Pacific, we shall proceed with a discussion of each of these three sectors, dealing with the resources, the techniques of harvesting, resource management and resource utilisation. A final chapter will discuss the part played by government authorities in the fishing industry and its prospects for development.

2. GEOGRAPHIC AND ECONOMIC CONTEXT

This paper covers the geographical area occupied by the 22 member nations of the South Pacific Commission, a technically-oriented region-wide international organisation. The dominant feature of this area is the immensity of the ocean, stretching diagonally over more than 12,000 km from Palau to the NW to Pitcairn Island to the SE. Thus the member nations and territories are often separated by thousands of kilometres from the nearest continental land-mass, and two adjacent countries are seldom within less than 500 km of each other. This isolation, dramatised by the ratio between the area of the EEZ and the actual land area of any given country (called the "*isolation index*" by F. Doumenge, 1985), constitutes a severe handicap for the economic integration of the region's nations within the global economy. On the other hand, when it comes to commercial tuna fisheries, it represents an undeniable asset. Thus the introduction of the Exclusive Economic Zones increased the economic surface area of certain nations by a factor of 1000. We may note a difference in this regard between Melanesia and both Micronesia and Polynesia. Melanesia is made up of high continental islands, of hundreds if not thousands of square kilometres[1]. There, population densities are often less than 10/km2. It is divided into five island groups, each over 10,000 km2 in area, and having an isolation index of less than 100 (see Table 1). By contrast, Polynesia and Micronesia are a mere dusting of high islands, atolls and raised coral reefs scattered over the face of the ocean, grouped in archipelagoes of small land area[2], often less than 500 km2, and with isolation indices which can exceed 1000. The average population density is 65/km2 for Polynesia, and 128/km2 for Micronesia. This latter region differs from the former by a faster population growth, similar to that of Melanesia. In Micronesia, population growth rates were in excess of 2% for the period 1980-1990, with population doubling cycles of less than 35 years. Apart from French Polynesia and American Samoa, Polynesian population growth rates are everywhere less than 2% per year. Five out of the ten Polynesian nations of the region have zero or negative growth rates, due to massive emigration toward New Zealand, the United States and Australia (see Table 1).

Small population figures and small land areas combine to produce crippling limitations to the viability of island economies[3], and to the development policies needing to be implemented (Jalan, 1982; Hein, 1988; Poirine, 1995).

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[1] Papua New Guinea by itself represents 84% of the whole of the land area of the region; its population represents 61% of all the inhabitants of the island Pacific.

[2] Together, Polynesia and Micronesia represent only 2% of the whole of the land area of the island Pacific, 13% if one does not include Papua New Guinea.

[3] According to F. Doumenge (1993, p.2), the viability of a small island nation can be expressed both by a static condition: *"the combined presence of the necessary and sufficient conditions required for continued existence"*, and a dynamic one: *"the conditions that will enable it to develop, both in the sense of the most comprehensive use possible of the available natural resources and in*

Table 1 - South Pacific countries, geographical background (from S.P.C., 1995)

Country	Sea area (000sq.km) (a)	Land area (sq.km) (b)	a/b	Population estimate 1995	Populat. doubling time (iyears)	Urban /l country populat. (%)	GDP per capita (A§)
Melanesia	**8 170**	**539 364**	**15**	**5 531 300**	**30**		
Fidji	1 290	18 272	70	774 800	35	38.5 (1)	2 312 (7)
New Caledonia	1 740	19 103	91	182 200	35	69 (2)	16 350 (2)
Papua New Guinea	3 120	462 243	7	4 042 400	30	15.5(3)	1 302 (3)
Salomon Islands	1 340	27 556	48	367 800	20	12.5 (1)	734 (3)
Vanuatu	680	12 190	56	164 100	25	18.5 (2)	1379 (3)
Micronesia	**10 603**	**3 214**	**3 299**	**471 800**	**20**		
Federated States	2 978	701	4 248	105 700	13-26	27.5(4)	4 837 (3)
Guam	218	541	403	149 300	30	38(3)	12 374 (1)
Kiribati	3 550	811	4 377	78 400	30	35 (3)	696 (2)
Marshall	2 131	181	11 773	54 700	17	64.5 (5)	1 514 (8)
Nauru	320	21	15 238	10 500	24	100 (6)	22 418 (2)
Northern Mariana	777	471	1650	56 700	7	53(3)	12 851 (9)
Palau	629	488	1289	16 500	35	69.5 (3)	3 564 (9)
Polynesia	**10 750**	**8 195**	**1 311**	**580 700**	**46**		
American Samoa	390	200	1950	54 500	19	48.5 (3)	6 660 (9)
Cook	1 830	237	7721	19 100	63	58.5 (7)	4 837 (3)
Wallis-Futuna	300	255	1176	14 400	53	0	16 (10)
Niue	390	259	1505	2 000	?	30.5 (7)	1 553 (8)
Pitcairn	800	5	160 000	54	?	0	?
French Polynesia	5 030	3 521	1429	218 000	28	56.5 (5)	19 745 (3)
Tokelau	290	10	29 000	1 500	?	0	478 (4)
Tonga	700	747	937	98 300	139	30.5 (1)	1 297 (3))
Tuvalu	900	26	34 615	9 500	41	42.5(7)	1245 (3)
Western Samoa	120	2 935	41	163 400	139	21 (7)	936 (3)
S.P.C. region	**29 523**	**550 773**	**54**	**6 583 800**	**30**		
S.P.C. region less Papua New-Guinea	**26 403**	**88 530**	**298**	**2 541 400**			

(1) : 1986 (2) : 1989 (3) : 1990 (4) : 1980 (5) : 1988 (6) : 1992 7 : (1991) (8) : 1984
(9) : 1985 (10) : 1983

Throughout the region, the primary sector forms the basis of the economy, both in terms of quantities produced and in the number of persons employed. Agriculture is the mainstay of the majority of the islands; a few rely on mining of metallic ores or of phosphates, and fewer still rely on fishing. In general the industrial sector is little developed, and is mostly focused on processing industries for the primary products: smelting of nickel in New Caledonia; canneries or deep-freezing facilities for fish and meat products and sugar industry in Fiji; fruit-juice manufacturing, etc. Apart from Fiji, where the garment industry has enjoyed undeniable growth, the manufacturing of equipment and

consumer goods other than food products is only just beginning[4]. Service activities on the other hand are growing apace, due to urban expansion, tourism development, and the growth of national or territorial administrations that followed independence and recent policies of decentralisation. Within the French and American territories, the economy is essentially fuelled by cash transfers from the mother country (Blanchet, 1994; Poirine, 1993, 1994; Freyss, 1995). There, the gross national domestic product is generally in excess of A$ 10,000 per person, while it is below A$ 2500 among the region's independent nations, although these latter receive more foreign aid per inhabitant than any other country worldwide (Antheaume and Lawrence, 1985).

3. THE NON-STRUCTURED SECTOR

3.1 The resources

The non-structured sector of the fishing industry operates within the intertidal zone, inner lagoons and the first few meters of the reef wall. These areas offer a great diversity of targets. Roughly 4000 species of coral fish have been counted in the region (Meyers, 1989). In Papua New Guinea alone, Kearney (1975) estimated at 1500 the number of species to be found within coastal waters. The majority of these species are edible, and are the target of regular or occasional fishing effort. Even in a much smaller and morphologically much more homogenous country such as Vanuatu, nearly 500 coral fish species have been identified (Williams, 1990). We shall differentiate here between bottom and offshore species. The former are dependant on sustaining environments, which may be distributed through a particular area over a number of locations of limited extent, where specimens of any species (fish, crustaceans, shellfish) are widely scattered, and where specific biomass per ecosystem is low (Kulbicki, 1992). Generally speaking, the coral fish of the island Pacific can be divided by species into two major groups: one belonging to the Western Pacific, stretching from Micronesia to New Caledonia, and one characteristic of the Eastern and Southern Pacific, which includes the Hawaii-Polynesia complex and the southernmost islands from Norfolk to Kermadec. In contrast to the bottom dwellers, the offshore species, because of their migratory and schooling habits, may represent biomass-per-hectare figures that can locally and occasionally run very high. Their specific diversity, however, is much lower.

3.2 Harvesting of the resources

Although during earlier times Pacific Islanders have made use of canoes up to 40 meters long for their offshore voyaging, particularly at the time of inter-island migrations, the canoes in use today along the island shores are considerably smaller (typically 4 to 5 meters long). These are usually outrigger dugouts, propelled by paddle. Sailing canoes, once common, have become rare.

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the sense of continued improvement in the social and economic standard of living for the population".

[4] The establishment of one single company can often dramatically alter the economy of a Pacific island nation, as illustrated by the recent establishment of an Australian automotive industry sub-contractor in Western Samoa: its 1500 employees represent nearly 10% of the country's 16000 wage earners (figure for 1986, World Bank, 1993).

In some countries, alongside canoes following traditional design, we find fiberglass canoes without outriggers (Solomon Islands), or timber planked canoes with outriggers (Kiribati). All these "modern-design" canoes are fitted with small outboard motors.In many places, the canoe is not used exclusively for fishing purposes, and often doubles as passenger and produce carrier. What is more, all fishing outings are not done in boats, and are often accomplished by wading in intertidal areas, or fishing the first few meters of the reef wall and around lagoon coral heads. This type of fishing is usually limited to the immediate neighbourhood of the village.

A wide variety of fishing gear is used (Anell, 1955; Pernetta and Hill, 1981; Halapua, 1982; Hooper, 1989; David, 1994; Falanruw, 1994; Taniera, 1994). The majority consists of throwing or shooting devices (spears, bow-and-arrow, throw nets, spear-guns), or passive devices (fish-traps, gillnets, fish-pens). The equipment usually belongs to the fishermen, all of whom can be classified as small tradesmen. Although the materials used for the manufacture of the fishing gear is increasingly of industrial origin, the designs and mode of operation remain mostly traditional. Generally speaking, the gear is small, and can be easily carried by the fisherman; it is inexpensive and often home-made. Until about thirty years ago, the monofilament fishing-line was the only "modern" piece of fishing gear used by the islanders; the rest of the equipment was of traditional construction, whether spears, bows or fish-traps. Today, these traditional implements are disappearing, or becoming reserved for a particular group: bows are now only used by children, while fish-traps are reserved for women. Among traditional implements, the hand spear remains the most widespread, and is used by men and by children. Line fishing has remained very popular; it is very versatile, considering the diversity of both its users[5] and its applications[6] it is inexpensive and universally available, even in the most remote sea-shore villages. In general, the costlier devices such as casting nets are reserved for the men. The geographical distribution of these devices is closely linked to local purchasing power, and to transport facilities between the fishing village and the retail outlets, usually limited to towns or the larger villages. The spear-gun is another piece of equipment which appeared within the last thirty years. Besides the fairly rare factory-made models, expensive and only available in the larger towns, one finds many rudimentary village-made models, consisting of a metal spear, often barbless, and a rubber sling attached to a piece of wood no more than 10 cm long on which the extremity of the spear rests when the gun is cocked.

Alongside devices which are obviously designed specifically for fishing, we find tools of a more diversified usage, fishing being but one of their many applications. The most common of these is the machete, or bush-knife; every rural household owns at least one. Fishermen often use it to slash the fish trapped in the pools left by the retreating tide on the reef flat, or during fishing outings done on foot at night. The bush-knife is used indifferently by men, youths and women. Steel rods, less common, are used exclusively by women to catch octopus at low tide and to overturn rocks in search of shellfish; these are often the spear from a spear-gun, where the men of a household own such a device.

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[5] Line fishing is the only technique that is used indifferently by men, women and children.

[6] The fishing line can be used trolling or bottom fishing, from a boat or on foot from the edge of the reef flats and in the intertidal zone.

A third type of fishing technique makes use of what we may term one-time implements. In this category, we will mention particularly the use of coconut fronds and of vegetable poisons. Coconut leaves are used as a gathering net. Plaited, they are assembled to form a rough mesh, ten meters long or so, still used in the Banks Islands to drive small fish to the head of narrow bays, where they are then killed using spears or bush-knives. Vegetable poisons are made from *Barringtonia* or *Derry* leaves, small trees growing near the shore; the leaves are bruised, finely chopped, pulped or tightly folded, then placed in a pool where they tend to poison the whole of the fauna.

Explosives, the quintessential one-time device, were popular during the first half of the century, particularly the years immediately following WWII; they do not appear to be much in use today, mostly due to scarcity and to government policies aimed at banning the practice.

3.3 Resource management

Given the small size of the fishing grounds, and the sensitivity of the resource to over-intensive harvesting, traditional fishing has often to face the threat of over-exploitation when serious fishing is maintained over long periods of time. For fishing to remain viable, the activity must be regulated. The traditional solution to this situation is to control access to the resource by means of temporary bans on fishing enforced on the whole village community which owns the fishing grounds and each village may be said to have its marine tenure system (Sudo, 1984; Hviding, 1989; Teulières, 1989; Zann, 1989). These bans, or taboos, are placed by the community chief during a special "custom" ceremony, and are usually made evident by some sign understood by all, such as a pole stuck in the reef flats. These taboos can be total, in which case they apply to the whole of the useable species, or partial and apply only to the most threatened species. The duration of such interdictions can be highly variable, but it is seldom less than six months and rarely more than three years. Any community member breaking the taboo is liable to a heavy "custom" fine, a deterrent sufficient to make taboo breaking a rare occurrence. The effectiveness of such taboos rests on the fact that the fishing territory is open to the flow of eggs and larvae of fish, invertebrates and shellfish coming from outside. This allows a gradual repopulation of the habitats depleted by over-fishing. This potential for regeneration of fishing stocks, characteristic of the reef environment, is a great asset and offsets its high vulnerability to over-intensive fishing. All species do not have the same potential for repopulating the depleted habitats. Species whose larvae develop in open waters have an advantage when compared with those whose larval stage is mostly spent attached to the bottom. The former, drifting with tides and currents, can cover great distances; the latter can only spread over a small area, and thus can only gradually, step by step, repopulate the depleted habitats from their laying grounds.

Once the temporary ban on fishing is lifted, all members of the village community regain access to the fishing grounds. However, this access remains subject to the permission of the local chief for any outsider to the community. The formality of these authorizations will depend on the legal status of the land to which the fishing grounds belong. The fishing grounds are considered part of

village territory, and as such they are viewed with the same feeling of ownership and identification as the land part of the territory[7]. Where the fishing grounds are thus perceived as an extension of the cultivated gardens within the village territory, access to outsiders is very strictly regulated. This access is usually reserved for groups considered as allies. We may encounter two types of situations : one case would be a neighboring group who has placed its own fishing grounds under temporary taboo and requests permission to share the village's fishing resources for the duration of the ban, another case could be an inland group, holder of a landlocked territory, wishing occasional access to the ocean. In both cases, the granting of a fishing-rights agreement will be the occasion of a traditional ceremony to cement the alliance between the two groups.

When the fishing grounds are perceived as part of the non-cultivated portion of the territory, their have a lesser status, and the granting of access to outsiders follows a less formal procedure. In certain islands, this access may even be free to all, at least this is claimed by members of the community. The inalienable relationship between the land and its inhabitants runs so deep in Pacific Islands that it would seem extraordinarily for anyone wishing to fish in a territory not his own to fail to inform the rightful owners and seek their permission to do so. Thus, even in cases where outsider access to the resource isn't governed by a set of formal traditional rules and procedures, it is still subject to the traditional usage regarding land-rights, a body of customs which will be implicitly respected.

3.4 Fishing production and its utilisation

Over the 1989-1992 period, the production of the non-structured coastal fishing sector has been estimated at approximately 80,000 tonnes (see Table 2). Apart from New Caledonia and Guam and, to a lesser extent, French Polynesia where leisure fishing represents one third to one fifth of the non commercial production, 90 to 95% of this total consists of the catch of village fishing. Thus, village fishing production may be estimated at 70,900 to 75,200 tonnes, with leisure fishing accounting for 4,800 to 9,100 tonnes; during the same period, the commercial fishing catch amounted to barely one third of these figures, namely 16, 400 tonnes of fish, 1,900 tonnes of crustaceans, 3,900 tonnes of mother of pearl shell and of sea slug. Generally speaking, the production of village fishing per inhabitant is twice as high in Polynesia as in Melanesia, where it is only one fifth of what it is in Micronesia (see Table 3).

The most prevalent use of the production of non-structured village fishing is to supply the fisherman's family needs. In certain Micronesian or Polynesian countries, such as Kiribati or Tuvalu, each family goes fishing at least once a week, and consumes an average of 80 kg of fish per person per year. There, fish provides nearly the whole of the animal protein intake. Elsewhere, fishing activities are less frequent. Nevertheless, with the exception of Papua New

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[7] In the island Pacific, as was shown by Bonnemaison (1981 and 1986), the notions of territory and of ethnic identity are very much interweaved. "*The sense of ethnic identity is based on, and finds its security in, the depth of its rooting to the land and the degree of intimacy it enjoys with a space that it structures, orders and focuses according to its own aspirations and symbolic representations, in other words its territory.*"

Guinea which is almost a continent, and of Nauru and Guam where subsistence activities are rare, it can be said that over one third of Oceanian rural households go fishing at least once a week.

Table 2 - Mean annual village fisheries production in the Pacific Islands 1989-1992 (from Dalzell & Adams, 1994)

Country	Subsistence fisheries production (t)	Nominal value ('000 US $)	Commercial fisheries production (t)	Value ('000 US $)	Total fisheries production (t)	Nominal value ('000 US $)
Melanesia	50,833	98,997	14 121	51768	64 954	150,765
Fidji	16,200	40,118	6,506	18,980	22,706	59,098
New Caledonia	2,000	7,345	1,032	4,833	3,032	12,178
Papua New Guinea	20,588	41,176	4,966	22,097	25,554	63,273
Salomon Islands	10, 000	8,405	1,150	4,344	11,150	12,749
Vanuatu	2, 045	1,953	467	1,514	2,512	3,467
Micronesia	18,849	32,502	5,504	10,954	24,353	43 456
Federated States	6,243	11,237	646	1,502	6,889	12,739
Guam	472	1,936	114	434	586	2,370
Kiribati	9,084	13 374	3,240	4,770	12,324	18,144
Marshall	2,000	3,103	369	715	2,369	3,818
Nauru	98	220	279	628	377	848
Northern Mariana	202	827	120	493	322	1,320
Palau	750	1,805	736	2,412	1,486	4,217
Polynesia	10,366	28,825	4,985	20,631	15,351	49,456
American Samoa	215	814	52	179	267	993
Cook	858	3,048	124	314	982	3,362
Wallis-Futuna	862	4,310	138	1,285	1,000	5,595
Niue	103	471	12	55	115	526
Pitcairn	8	16	0	0	8	16
French Polynesia	3,108	12,432	2,891	15,574	5,999	28,006
Tokelau	191	105	0	0	191	105
Tonga	933	1,901	1,429	2,807	2,362	4,708
Tuvalu	807	658	120	98	927	756
Western Samoa	3,281	5,070	219	319	3500	5,389
S.P.C. region	80,048	160,324	24,610	83,353	104,658	243,677
S.P.C. region less Papua New-Guinea	59,460	119,148	19,644	61,257	79,104	180,405

Such is the case in Vanuatu (Anon., 1986, 1994) where the share of the non-commercial sector in the overall production is slightly higher than the regional average (81% vs 75%), but where the annual production per person is considerably below the regional norm (1.5 kg vs 24.9 kg). Fishing for self-consumption is of paramount importance in achieving dietary self-reliance for the island countries. In 1984, small-scale non-structured village fishing provided Vanuatu's consumers with 228 to 263 tonnes of protein. When one considers that it takes an average of 5.715 tonnes of tinned mackerel to make up one tonne of pure protein, and that one tonne of imported tinned fish costs US$ 1206, the

small-scale non-structured village fishing sector can be said to have saved the nation US$ 1.57 to 1.81 million by doing away with the need to import 1305.5 to 1504 tonnes of tinned fish[8] . Importing this extra quantity of goods would have increased the value of total food imports by 13.5 to 15.5%, and increased the trade deficit by 6.3 to 7.4% (David and Cillaurren, 1992a and b). By applying a similar calculation, the World Bank obtained savings figures for 1992 of US$ 8.22 million for Fiji, US$ 7.66 million for the Solomon Islands, and US$ 2.58 for Western Samoa.

Table 3- Structure of the village fisheries production 1991 and production *per capita* (from SPC, 1993 and Dalzelle & Adams, 1994)

Country	Subsistence fisheries production (%)	Commercial fisheries production (%)	Subsistence fish.product./ population estimate 91 (kg / year)	Commercial fish.product./ population estimate 91 (kg / year)	Total fisheries production./ population estimate 91 (kg / year)
Melanesia	78	22	9.4	2.6	12
Fidji	71	29	21.8	8.8	30.6
New Caledonia	66	34	11.5	5.9	17.4
Papua New Guinea	81	19	5.2	1.2	6.4
Salomon Islands	90	10	30.5	3.5	34
Vanuatu	81	19	13.5	3	16.5
Micronesia	77	22	42.4	12,4	54,8
Federated States	91	9	55.9	5.8	61.7
Guam	81	19	3.4	0.8	4.2
Kiribati	74	26	124	44	168
Marshall	84	16	41.5	7.5	49
Nauru	26	74	10.3	29	39.3
Northern Mariana	63	37	4.1	2.4	6.5
Palau	50	50	48.1	47.2	95.3
Polynesia	68	32	18.8	9	27.8
American Samoa	81	19	4.4	1.1	5.5
Cook	87	13	49.3	7.1	56.4
Wallis-Futuna	86	14	62	9.9	71.9
Niue	90	10	46.8	5.5	52.3
Pitcairn	100	0	160	0	160
French Polynesia	52	48	15.4	14.4	29.8
Tokelau	100	0	119	0	119
Tonga	40	60	9.6	14.7	24.3
Tuvalu	87	13	88.7	13.2	101.9
Western Samoa	94	6	20.4	1.3	21.7
S.P.C. region	76	24	12.6	3.9	16.5
S.P.C. region less Papua New-Guinea	75	25	24.9	8.2	33.1

[8] Actual quantities imported amounted to 795.4 tonnes, representing a dollar value 1.6 to 2 times lower.

Generally speaking, the more remote and the poorer an island, the greater the amount of fish caught for self-consumption. In the towns, fishing activities rarely concern more than 10% of the population, and the bulk of urban fish supplies comes from the commercial circuits. There are notable exceptions to this rule: among the inhabitants of Tarawa (Kiribati), 65% go fishing at least once a week (World Bank, 1995). In such cases, the sea-bed is subjected to massive over-exploitation, endangering the survival of the resource; harvesting beyond the level of sustainability has also been noted in Western Samoa where the productivity of reef fishing near urban areas is down to 28 kg/ha, compared with 120 kg/ha for reef areas not affected by urbanisation (Zann, 1991).

For the past two decades, the integration of subsistence activities within the market economy has progressed significantly throughout the region, with some notable exceptions as for instance New Caledonia. Fishing activities are part of this evolution. Thus in Vanuatu, in 1983, 13 to 23% of fishermen were offering their catch on the market (David, 1991a); the figure was up to 40% by 1993 (Anon., 1994). Their production output is substantially higher than that of those fishing strictly for self-consumption. The sale of the product is usually carried out directly by the fisherman or his family, and the buyers are normally from the same village or its immediate surroundings. However, with the rapid urban expansion taking place in Melanesia and Micronesia, the small-scale non-structured village fishing sector is evolving; while keeping to the same fishing methods, it is getting more organised from the marketing point of view. Middlemen are beginning to appear, who purchase the catch of village fishermen and dispose of it in the towns. In some countries, the distribution circuits even extend to adjacent islands. In the Solomon Islands for instance, 75% of the fresh fish offered for sale in Honiara comes from the production of the non-structured village fishing sector of Central, Isabel and Malaita provinces.

4. THE SEMI-STRUCTURED SECTOR

The semi-structured sector of village fishing consists of fishing operations where only the marketing of the catch is fully structured; in this category, we will include pearl-shell and sea-slug gathering, and the large permanent fish pens of French Polynesia

4.1. Pearl-shell and sea-slug gathering

If one considers only the techniques of gathering, these activities should rightly belong to the non-structured village sector; yet, they represent one of the first footholds of the Pacific islands in the global economy (David and Pillon, 1995). As early as the 1830's, a flourishing trade in *trepang* (dried and smoked sea-slug) was established between the island Pacific and Asia. By the beginning of the XXth century, the gathering of trochus shell for its mother-of-pearl had become the main cash activity of the New Caledonian waterfront; by the end of the 1950's, this activity was in full expansion in Vanuatu, Fiji and the Solomon Islands. The economic importance of the troca shell led the Japanese to attempt introducing the species to the reef flats of Micronesia during the 1930's. After the war, this was also done successfully in French Polynesia and in the Cook Islands (Doumenge, 1966). In spite of this broadening of the trochus'geographic

distribution, its commercial exploitation is mostly limited to Melanesia, which supplies 70% of the Japanese market (Japan, Korea and Europe represent the bulk of world demand for the product). Trochus are usually exported unprocessed, as empty sells. The methods of gathering have changed little over the last fifty years. Although it could be highly lucrative, trochus fishing has remained an occasional activity and professional troca fishermen are rare; this is mostly the result of the vulnerability of the stock to over-exploitation, a weakness which is evidenced by the fluctuations of production figures (see table 4). In Fiji this production dropped from 398 tonnes to 52 tonnes over five years, while the production of the Solomon Islands went from 662 tonnes in 1986 down to 86 tonnes in 1991, only to shoot back up to 270 tonnes in 1992 and 375 tonnes in 1993.

Table 4 - Export of trochus products, 1988-1993

Country	1988	1989	1990	1991	1992	1993
Fiji	398	236	226	100	71	52
Solomon	460	372	307	86	270	375
Vanuatu	42	20	9	32	?	14

Source : Fiji Fisheries division, Solomon Islands Statistic Office, Vanuatu Statistics Office

As is the case for the trochus, the sea-slug is a high demand product on the world market, particularly in Singapore and Hong Kong. Over the period 1978-1986, the annual catch varied from 10,000 to 54,000 tonnes, with 70 to 90% of the production coming from the island Pacific (Conan, 1989). The fragility of the resource and the lack of any rational resource management explain, much as for the troca, the fluctuations of production figures from year to year. Between 1988 and 1989, Fijian production went from 717 tonnes down to 365 tonnes, leading to a dramatic expansion of this activity in the Solomon Islands, where production increased sevenfold between 1989 and 1991, eventually reaching 1975 tonnes in 1992. Since then, production has dropped sharply, and operations have been shifting to Micronesia and Polynesia (World Bank, 1995). Although the main outlet for sea-slug is export to the world market, islanders occasionally consume it themselves; it is eaten raw in Wallis, Samoa and Palau, roasted in Papua New Guinea, and boiled in coconut milk in Fiji (Conan, 1989).

4.2 The fixed fish-pens of French Polynesia

This type of structured village fishing activity is mostly found in the atolls of French Polynesia. It consists of constructing fish holding pens at right angle to the beach or across passes in the reef (Blanchet *et al.*, 1985). These are made up of long lengths of "chicken wire" galvanised mesh, about 1.5 m high, held vertically in place by 50 to 200 wood or steel stakes driven into the sand or coral bottom. They are the descendants of the traditional fish-pens of coral blocks once common on the reef flats throughout Polynesia and Micronesia (Falanruw, 1994; Parry, 1994). Considering their high initial purchase cost (US$ 2500 to 6000 in French Polynesia) and the expense of maintaining them (the life expectancy of the wire mesh in sea water is not much over six months), the devices can only be constructed and operated on a continuing basis by a limited number of fishermen having access to a substantial initial capital. This is quite different from the

inexpensive operating conditions of pearl-shell or sea-slug gathering. Placing the fish-pens in sheltered sites at the head of protected bays increases the life of the materials, and thus lowers operating costs, but such locations tend to be less productive. For this reason, those fish-pens set up in sheltered sites tend to be used only occasionally, and only represent casual income for their owners, who pursue other activities such as agriculture. In French Polynesia, the authorities have been subsidising this type of fishing, particularly by supplying free materials for the construction of the pens; this allowed many fishermen, who would not otherwise have had access to sufficient capital, to take up the practice.

5. THE STRUCTURED SECTOR

Both production and marketing are structured; this category covers artisanal fishing operations targeted on deep-bottom species and pelagic species. Generally speaking, both types of species are fished by the same fishermen and, apart from French Polynesia, the emphasis is rather on fishing the outer slopes of the reef wall for species dwelling at depths of 100 to 400 meters.

5.1 Fishing for deep-bottom species

These are mostly *Lutjanidae* (and sub-families *Etelidae* and *Apsillinae*), *Serranidae* and *Lethrinidae.* From the consumer point of view these species have the great advantage of being free from the ichtyo-toxin contamination that affects many lagoon reef species. From the point of view of the fisherman, they have the advantage of being sedentary and available all year round, while often yielding impressive catches; the areas where they are found are usually beyond the range of traditional canoes, and the habitats had mostly never been fished before modern times. Fishing operations on these grounds started toward the end of the 1970's and early 80's[9], at the initiative of the South Pacific Commission, which sponsored many exploratory missions aimed at assessing potential marine biological resources and stock levels (Dalzell and Preston, 1992). The objective was to establish, alongside "traditional" unstructured village fishing, a structured sector of commercial fishermen issued either from the pool of "traditional" fishermen attracted by the lure of cash profit, or, more rarely, from small businessmen interested in fishing ventures. The exploitation of the newly discovered resources requires the use of motorised craft able to operate several miles offshore. Two models are commonly used in the region for this purpose: 8.6 meter "Alia" catamarans, designed by F.A.O. for Western Samoa, and 5 and 8 meter monohull craft fitted with 25 hp engines. Longline fishing not being well developed in the region, these boats are equipped with 2 to 4 bottom lines on hand operated wooden reels. In 1984, a catamaran complete with two engines and its fishing equipment was selling for US$ 9000, and a 5 meter monohull for US$ 5400. Such sums are disproportionate with most fishermen's income level: one must remember that for that same year, the average monthly income of a rural household in Vanuatu was US$ 780. Thus a large portion of this equipment has to be subsidised by the authorities through allocation of foreign aid and through low-interest loans by the national development banks. This financial assistance is complemented by technical back-up by field agents of the national fisheries departments who provide training in the use and maintenance of the

[9] The only area where these resources have been exploited for several decades is the Hawaii Group.

fishing equipment. The preservation of the catch is also a prime concern for the authorities. It is in this facet of operations that government is most involved. Everywhere, emphasis has been put on preservation by cold storage. Three types of equipment are used by artisanal fishing in this regard: gas or kerosene refrigerators and freezers, ice-making machines capable of producing several hundreds of kilograms of block or shaved ice to be mixed with salt water in an ice chest to produce a brine at 3 to 4°C in which the fish is chilled, and walk-in freezer facilities of about 20 m^3 capacity. All this equipment is very expensive[10], and it is only through government financial assistance that certain groups of fishermen are in a position to acquire them. Apart from its high initial purchase cost, the spreading of refrigeration equipment through the fishing community is hampered by the lack of technical assistance in case of breakdown. An investigation carried out in 1984 by the South Pacific Commission throughout the member nations showed that only 30% of the refrigeration equipment installed in rural communities was operating without problems. Problems resulting from low fuel quality and electrical failures were the most common reasons for break-downs. Because of the scarcity of spare parts and qualified mechanics, 40% of the installations were no longer in use (Preston and Vincent, 1986).

In certain island nations such as the Solomon Islands, Tonga and Vanuatu, government involvement in the fishing sector goes far beyond simple assistance in setting up refrigeration equipment. Government fish markets have been established in urban centres, to dispose of the production of village fishermen associations. This approach has mostly been a failure, on account of growing competition from more cost-effective private fish marketing operations.

5.2 Fishing for pelagic species

Apart from French Polynesia, where fishing craft were specifically designed for fishing pelagic species, particularly the dorado (also known as mahi-mahi or dolphin-fish) and the flying-fish (Blanchet *et al.*, 1987), fishing for pelagic species is done using the same boats as those used for deep-bottom species, with trolling reels being fitted instead of the wooden bottom-line reels. On account of the mobility of the fish schools, of the limited power of the crafts' engines, and of the small size of the crafts themselves, fishing is often poor or insufficiently lucrative. The use of FAD's (Fish Aggregation Devices) has much improved this situation by doing away with the need for lengthy cruising in search of fish (Cillaurren, 1988). Nowadays, the fisherman simply goes directly to the floating raft of the FAD. These devices cost between US$ 3000 and 12000 each, and their life expectancy does not extend much beyond 14 months. Until now, the entire cost of initial installation and subsequent replacement of the FAD's has been borne by governments; yet, the people who most use the facilities are not the associations of commercial fishermen, but leisure fishermen. The reason for this is that the devices are usually set up far offshore, and only the fast and powerful boats belonging to affluent leisure fishermen can justify the length of the voyage by being able to spend much longer fishing at the site of the rafts (Cillaurren, 1990a and 1990b). Thus in many countries, the installation of FAD's did not produce the expected results of assisting the development of artisanal

[10] In 1984 in Vanuatu, an ice-maker cost US$ 17,000, and a walk-in freezer cost US$ 27,000 (Crossland, 1984).

commercial fishing. Admittedly, the subject was open to a certain ambiguity. The first objective of FAD implantation was to improve skip-jack catches (*Katsuwonus Pelamis*, also known as bonito), which were in turn supposed to be used as bait for deep-bottom line fishing. This species, often representing a considerable part of the pelagic fish caught around the FAD's, lost much of its commercial value in the process, thus making outings to the FAD's less profitable, and discouraging fishermen from giving up deep-bottom fishing time for journeys the FAD's, perceived as being of questionable value. And as for providing bait, it was soon discovered that sardines and other small pelagic fish commonly found at shallower depths could be used successfully as a substitute, and that the increase in catches resulting from the use of skip-jack for the purpose did not justify the extra time and effort required to travel to the FAD's to catch them.

6. DEVELOPMENT OF THE VILLAGE FISHING SECTOR - CURRENT SITUATION AND PROSPECTS

Vanuatu is one Pacific island nation where the development of artisanal fishing has been perceived by government as a priority issue. Following the period of confusion which surrounded independence, the need was felt to initiate what might be termed a "*blue revolution*", aimed at rationalising the exploitation of the coastal marine resources of the young nation, improving its dietary self-reliance, creating employment opportunities in rural districts which might help slow down urban migration, and improving the trade balance through export of fisheries products (David and Cillaurren, 1992a and 1992b). By 1989, the policies established in this regard could be considered as having failed (David, 1991b), at a time when official pronouncements throughout the island Pacific regarding village fisheries development were still highly optimistic. Since then, the fact of this failure has had to be accepted (World Bank, 1995). The results actually achieved fell far short of the objectives, and were thus far costlier than had been anticipated. The reasons for this failure are multiple. Some derive from internal inadequacies within the region's Fisheries Departments in implementing and following up development programmes (Cillaurren and David, 1995), in the management of government fish-markets and in organizing networks of product collection and supplies delivery. Others stem from poor understanding of the situation at the conceptual stage. It had been hoped that massive financial input and providing technical back-up would suffice to bring the projects to fruition. This failed to take into account the social, cultural and economic idiosyncrasies of small island states, where people prefer a variety of activities to any kind of technical specialization (to minimize risks of food shortages), place more importance on collective welfare than on individual achievement, and tend to be ruled by highly complex social relationships (David, 1994). It failed to allow for the geographical dispersedness of the island groups, or for the sketchy nature of their internal road networks, factors which introduce severe limitations to the flow of goods of any kind. Finally, it didn't consider the very limited purchasing power of the islanders, or the fact that most practice subsistence fishing at least to a degree, and are therefore that much less likely to purchase fish from the commercial sector.

In view of the demands for restructuring policies that are currently imposed by international money lenders, the authorities of the Pacific island nations have developed a tendency to reduce considerably their assistance to the structured

village fishing sector, and to remove themselves from the whole distribution and marketing aspect of the industry, these latter reverting increasingly to the private sector. Similarly, they have been strongly advised to stay away from the whole process of implantation of fish aggregation devices. This pulling away of the authorities in favour of the private sector is sometimes paralleled by a pulling away by the nationals from exploitation of deep-sea resources in favour of foreign operators. In this way, Vanuatu is considering granting a few fishing licences to New Zealander and Japanese longliners.

While that part of artisanal fishing which is subsidised and assisted by the authorities has mostly failed to meet its objectives, the last decade has seen the appearance of a small commercial fishing sector, grown out of subsistence fishing. Marketing of the catch is still mostly limited to the immediate vicinity of the fisherman's village, but in certain countries such as the Solomon Islands and Fiji, commercial distribution networks have began to develop, so that we witness the beginning of a semi-structured small-scale village fishing industry without any government assistance. The commercial gathering of shell-fish and crustaceans is also growing, particularly that of pearl-shell and lobster. This evolution is taking place together with a general increase in the overall fishing effort, the result of, on the one hand, the increase in foreshore population and, on the other hand, the increase in fishing activity of former subsistence fishermen now marketing the whole or a part of their catch. The pressure that this increase is placing on the resources raises more than ever the problem of rational resource management, in order to avoid generalized over-exploitation in the vicinity of the larger population centres, and the disappearance of the stocks of pearl-shell and sea-slug. It would seem that legislation at the national scale, usually in the form of minimum size regulations, is not very effective. Government agents in charge of the legislation are too few to enforce it effectively in the field. Much thought is being given to the introduction of fishing regulatory mechanisms making use of the village marine tenure system, through temporary bans on fishing reminiscent of the taboos decreed by the chiefs in earlier times. Fiji, where there already exists a survey record of "custom" land ownership structure, is in the vanguard of this approach. It has been proposed that ownership titles to maritime areas be given to village communities (*yavusa*) having traditional rights over the waterfront. These titles would guarantee their exclusive rights to offshore areas from the high water line to the fall of the reef wall, or any other recognized boundary. By the end of 1994, three quarters of the traditional fishing grounds (*qoliqoli)* had been surveyed and put on record, and the attribution of property titles is due to begin in 1996.

Recognition of the existence of traditional maritime rights at village scale, and official survey of their boundaries represent an important step forward, but it would be unrealistic to believe that, by itself, this would solve all the problems. To work, village level resource management depends on a very important requirement : the continued respect for the traditional system of authority. This is still usually the case, as long as fishing is limited to the traditional activity for self-subsistence, or to a small-scale commercial pursuit with only the village, and perhaps the neighboring villages, for a market. On the other hand, once the resource has to supply demand at the national and possibly international scale, there is no guarantee that "custom" authority will be powerful enough to enforce respect of the necessary temporary fishing taboos, or even that this authority will have any desire to impose such bans. Once fishing is capable of providing a

substantial income to the majority of families, it becomes difficult, in times of tight money, to deny this "manna" to the village community, even if means putting the fish stock in jeopardy. This situation occurs often in the case of trochus shell and of beche-de-mer. With world-wide supply of these products beginning to dry up, and demand remaining high, the prices paid to the producer are usually very attractive. The traditional economic system isn't geared to resist to such pressures. So it isn't unusual for fishermen to succumb to the lure of quick and easy money, and for concern for the survival of the resource to assume a secondary role.

In this type of situation, the State be able to control fishing activities. With the decline of traditional authority, too often helpless against the high stakes involved, the State is the only institution who can counteract the logic of the profit motive generated by international demand, by enforcing a regulation of supply at the national level. For this purpose, neither the quota system, nor a system of licensing, are satisfactory. The simplest solution is the best. It is based on acceptance at the national level of a minimum size for specimen caugh, in some cases a maximum size. The customs department can the monitor compliance to the size regulations at the point of export; any undersize product is immedialty destroyed, and a heavy fine levied against the exporter. In this way, demand will always be for legal sizes, thus allowing the stock the possibility of replenishing itself. In cases where the product undergoes a manufacturing process prior to exporting, such as for trochus shell, monitoring for legal sizes will be done at the place of fabrication. The Government would cancel the export licence of any company that refuses to co-operate in this monitoring.

The management of the resource has to be flexible and adaptable. Products aimed at the international market must come under nation-wide regulations. On the other hand, products aimed exclusively at the local consumer market can be placed under traditional control at the village scale, provided the regulations can be made to apply to every village. As we can see, there is still a long way to go before a resource management model inspired by traditional methods can be put into practice at national level.

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